JOHN THOMPSON MICROGEN®
Biomass- / Fossil Fuel-fired Boiler

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ACTOM

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To cater for the growing demand for small medium pressure power boilers suited to biomass and coal fired cogeneration applications, John Thompson developed the MicroGen boiler with a nominal steam generation capacity of between 20 and 25 t/h for steam pressures from 31 bar(g) to 61 bar(g). Market demand, however, dictated the need for a wider range of capacities and steam conditions for varying requirements.

As a result, the MicroGen boiler design now comes in two standard sizes, namely **MicroGenV** at a nominal 25 t/h capacity, and **MicroGenX** at a nominal 45 t/h capacity, both at steam pressures ranging from 31 bar(g) to 67 bar(g) to suit the particular steam turbo-alternator requirements. As single boiler power islands at 67 bar(g) steam conditions, these two boiler capacities correspond nominally with net electrical outputs of **5 MWe** and **10 MWe**. The compact design incorporates a single-drum configuration with a membrane-wall furnace construction and flag tube evaporator bank.

Energy Cost - In all industries, energy cost has become a major consideration in the management of existing plants and in the feasibility studies for potential new plants. Often, in remote areas or where exorbitant electricity prices from the national grid defeats the feasibility of a plant's operations, generation of power for own consumption has be-come a priority.

Co-generation - Processes that require steam as the heating medium could have potential for co-generation. In short, co-generation is where high-pressure steam is used to turn a back-pressure turbo-alternator while the exhaust steam is used as process steam. In this way, for a small increase in thermal input, the plant can generate electricity while also generating sufficient heat to meet the requirements of the particular process.

If a process produces combustible waste-products that can supplement the fuel feed-stock, the case for co-generation is made even stronger. Environmentally, the project becomes more attractive and viable if the fuel can be considered a renewable biomass fuel.

Fuel Types - In addition to coal, a wide variety of renewable biomass fuels can be burnt on the spreader fired stoker including; bagasse, wood-chips, -pellets, -pucks, sawdust, plantation forest waste, sunflower and cotton-seed husks, nut shells, corncobs, dried-hops and torrified biomass. The boiler furnace can also accommodate burners to combust liquid fuels such as car tire derived oil or digester gas.

Modular Design - The MicroGen boiler is configured to facilitate manufacture of the pressure-parts in large sub-assemblies to facilitate cost effective transportation and minimises expensive and time-consuming site construction work.

The furnace design incorporates; a CAD (continuous ash discharge) stoker, a suitably proportioned furnace and pneumatic fuel spreaders. This configuration can accommodate suspension-firing of small and light biomass size fractions while allowing heavier solid fuel particles to burn on the grate.

As thermal efficiency will be crucial for any energy project, the MicroGen boiler is supplied with a comprehensive heat recovery tower which includes a tubular air-heater and banks of extended-surface economiser. Flue-gas clean-up equipment is supplied to suit the site, fuel and/or customer specific requirements.

Design Capability - CFD technology is used to configure the furnace and gas pass dimensions to achieve optimum combustion and heat transfer while minimising the risk of erosion. John Thompson can also undertake the complete cycle design. This incorporates the heat/mass balance and selection of the appropriate number of MicroGen boilers matched with a back-pressure or extraction condensing turbo-alternator(s).

Turnkey Solution - John Thompson is a division of ACTOM, the largest manufacturer, solution provider, repairer and distributor of electrical equipment in Africa. We can therefore also engineer and install all electrical plant and associated equipment. Through our established relationships with several turbo-alternator suppliers, the most suitable turbine technology can be selected to best meet the budget and requirements of every power island project. Hence, acting as the turnkey supplier, John Thompson can package the complete power-island for every need and application using one or several MicroGen boilers matched with the required type and size of turbo-alternator(s).

Parameters		Power generation with MicroGenV				Power generation with MicroGenX			
		BPT[2]	ECT[3&4]	ECT	ECT	BPT[2]	ECT[3&4]	ECT	ECT
		100% process	60% process	20% process	100% condensing 0% process	100% process	60% process	20% process	100% condensing 0% process
Boiler feedwater temperature	°C	130	130	130	130	130	130	130	130
Boiler steaming rate	t/h	21.16	21.16	21.16	21.16	42.07	42.07	42.07	42.07
Steam pressure at MSSV[1]	bar(a)	67.90	67.90	67.90	67.90	67.90	67.90	67.90	67.90
Steam temperature at MSSV	°C	485	485	485	485	485	485	485	485
Extraction steam pressure for process	bar(a)	8.40	8.40	8.40	8.40	8.40	8.40	8.40	8.40
Process steam flow available	t/h	20.75	12.45	4.15	0.00	41.26	24.93	8.31	0.00
Turbine exhaust steam flow to condenser	t/h	N/A	7.14	14.34	17.93	N/A	14.30	28.78	35.64
Net electrical power generated	MWe	2.18	3.35	4.46	5.01	4.36	6.51	8.68	10.03
Net steam cycle efficiency[5]	%	67.39	50.25	32.83	24.12	67.43	50.12	32.47	24.28

Notes

1. MSSV – Main Steam Stop Valve
2. BPT – Back Pressure Turbine
3. ECT – Extracting Condensing Turbine with controlled extraction
4. The calculations are based on a water cooled condenser
5. Net steam cycle efficiency = (net power generated + heat to process) / (thermal energy in fuel based on Net Calorific Value)
6. Efficiency estimate based on dry fibrous biomass fuel as feedstock (22% moisture content)
7. Net electrical power = gross power at terminals minus boiler parasitic load

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